SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI I : 2024/2025

DBM30043: ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 26 NOVEMBER 2024
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** the questions.

ARAHAN :

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) The blood pressures of 100 patients in a hospital were measured and the information grouped as shown in Table 1(a).

Tekanan darah bagi 100 orang pesakit di sebuah hospital diukur dan maklumat dikumpulkan seperti yang ditunjukkan di dalam Jadual 1(a).

Table 1(a) / *Jadual 1(a)*

Blood pressure *Tekanan darah*	Frequency *Kekerapan*
110 – 119	22
120 – 129	27
130 – 139	25
140 – 149	14
150 – 159	7
160 – 169	5

Calculate:

Kira:

i. mean

min

[4 marks]

[*4 markah*]

ii. median

median

[6 marks]

[*6 markah*]

CLO1 (b) Based on the data given, calculate:
Berdasarkan data yang diberi, kira:

6, 10, 11, 15, 24, 3, 10, 24, 13, 4

i. Mode
Mod

[2 marks]
[*2 markah*]

ii. Variance
Varians

[6 marks]
[6 *markah*]

CLO1 (c) A fair dice is rolled. Calculate the probability of getting:
Satu dadu yang adil dilambung. Kira kebarangkalian untuk dapatkan:

i. $P(prime\ number \cap odd\ number)$
$P(nombor\ perdana \cap nombor\ ganjil)$

[3 marks]
[*3 markah*]

ii. $P(prime\ number \cup odd\ number)$
$P(nombor\ perdana \cup nombor\ ganjil)$

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Based on the following linear equations:

Berdasarkan persamaan linear yang berikut:

$$-2p + 4q = -3 - 3r$$
$$3p + 2q - 4r = 19$$
$$4p + 3q + 5r = -5$$

i. Determine matrix L and U by using Doolittle method

Tentukan matriks L dan U dengan menggunakan kaedah Doolittle

[10 marks]

[*10 markah*]

ii. Then, calculate the value of p, q and r

Kemudian, kira nilai p, q dan r

[8 marks]

[*8 markah*]

CLO1 (b) Determine the root for equation $f(x) = x^3 + x - 3$ by using Newton Raphson method with $x_0 = 1.5$. Give your answer correct to 3 decimal places.

Tentukan punca persamaan $f(x) = x^3 + x - 3$ dengan menggunakan kaedah Newton Raphson dengan $x_0 = 1.5$. Berikan jawapan anda betul kepada 3 tempat perpuluhan.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Identify the order and degree of the following differential equations:

Kenal pasti peringkat dan darjah bagi persamaan pembezaan yang berikut:

i. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = k^2 + \left(\frac{d^3y}{dx^3}\right)^3$

[2 marks]

[*2 markah*]

ii. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^5 + \sin x = 3$

[2 marks]

[*2 markah*]

CLO1 (b) Solve the following first order differential equations by using stated method:

Selesaikan persamaan pembezaan peringkat pertama berikut dengan menggunakan kaedah yang dinyatakan:

i. $\frac{dy}{dx} = x^3 + 5$; Direct Integration Method

; *Kaedah Kamiran Terus*

[5 marks]

[5 *markah*]

ii. $y^2\frac{dy}{dx} = \frac{e^{3x} + 3x}{y}$; Separating the Variables Method

; *Kaedah Pemisah Pemboleh Ubah*

[6 marks]

[*6 markah*]

CLO1 (c) Solve the following second order differential equations:

Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $\frac{d^2y}{dx^2} + 12y = 7\frac{dy}{dx}$

[5 marks]

[*5 markah*]

ii. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 9y = 0$

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Use the definition of Laplace Transform, $\mathrm{F(s)} = \int_0^\infty e^{-st} f(t)dt$ to construct the Laplace Transform for $f(t) = 7e^{-9t}$.

Gunakan definisi Jelmaan Laplace, $\mathrm{F(s)} = \int_0^\infty e^{-st} f(t)dt$ *untuk menghasilkan Jelmaan Laplace bagi* $f(t) = 7e^{-9t}$

[5 marks]

[*5 markah*]

CLO1 (b) Apply the stated theorem to construct the Laplace Transforms for the following functions:

Gunakan teorem yang dinyatakan untuk membina Jelmaan Laplace bagi fungsi-fungsi berikut:

i. $\mathcal{L}\{8\sin 4t - 4e^{-t}\}$; Linearity Theorem
; *Teorem Kelinearan*

[3 marks]

[*3 markah*]

ii. $\mathcal{L}\{\cosh 2t\, e^{4t}\}$; First Shift Theorem
; *Teorem Anjakan Pertama*

[3 marks]

[*3 markah*]

iii. $\mathcal{L}\{3te^{-3t}\}$; Multiplication by t^n
; *Pendaraban dengan* t^n

[4 marks]

[*4 markah*]

CLO1

(c) Solve each of the following using the specified method:

Selesaikan setiap yang berikut menggunakan kaedah yang dinyatakan:

i. $\mathcal{L}^{-1}\left\{\frac{2}{s}+\frac{3}{s-1}-\frac{s}{s^2+4}\right\}$; Table of Laplace Transform

; *Jadual Jelmaan Laplace*

[3 marks]

[*3 markah*]

ii. $\mathcal{L}^{-1}\left\{\frac{s+4}{(s-1)(s-2)}\right\}$; Partial Fraction method

; *Kaedah Pecahan Separa*

[7 marks]

[*7 markah*]

SOALAN TAMAT

FORMULA DBM30043 - ELECTRICAL ENGINEERING MATHEMATICS

<table>
<tr><th colspan="3">DESCRIPTIVE STATISTICS</th></tr>
<tr><td>Number of class</td><td>Sturges Rule, $k = 1 + 3.33 \log n$</td><td>Rule of Thumb, $2^k > n$</td></tr>
<tr><td>Mean</td><td>$\bar{x} = \frac{\sum x}{n}$</td><td>$\bar{x} = \frac{\sum (fx)}{\sum f}$</td></tr>
<tr><td>Median</td><td colspan="2">$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m}\right) C$</td></tr>
<tr><td>Mode</td><td colspan="2">$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$</td></tr>
<tr><td>Quartile</td><td colspan="2">$Q_k = L_{Q_k} + \left(\frac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$</td></tr>
<tr><td>Decile</td><td colspan="2">$D_k = L_{D_k} + \left(\frac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$</td></tr>
<tr><td>Percentile</td><td colspan="2">$P_k = L_{P_k} + \left(\frac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$</td></tr>
<tr><td>Mean Deviation</td><td>$E = \frac{\sum \left| x - \bar{x} \right|}{n}$</td><td>$E = \frac{\sum \left(\left| x - \bar{x} \right| f \right)}{\sum f}$</td></tr>
<tr><td rowspan="2">Variance</td><td>$s^2 = \frac{\sum \left(x - \bar{x} \right)^2}{n}$</td><td>$s^2 = \frac{\sum_{i=1}^{n} x_i^{\,2} - n\bar{x}^2}{n}$</td></tr>
<tr><td>$s^2 = \frac{\sum \left[\left(x - \bar{x} \right)^2 f \right]}{\sum f}$</td><td>$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f} \right]^2$</td></tr>
<tr><td>Standard Deviation</td><td colspan="2">$s = \sqrt{variance}$</td></tr>
</table>

<table>
<tr><th colspan="3">NUMERICAL METHOD</th></tr>
<tr><td>Crout Method</td><td>$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$</td><td rowspan="2">$Ly = b$
$Ux = y$</td></tr>
<tr><td>Doolittle Method</td><td>$A=\begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix}\begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$</td></tr>
<tr><td>Newton Raphson Method</td><td colspan="2">$x_{n+1} = x_n - \dfrac{f(x_n)}{f'(x_n)}$</td></tr>
<tr><td>False Position Method</td><td colspan="2">$x_0 = \dfrac{1}{y_2 - y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$</td></tr>
<tr><th colspan="3">PROBABILITY</th></tr>
<tr><td colspan="2">$E = pn$</td><td>$P(A \cup B) = P(A) + P(B) - P(A \cap B)$</td></tr>
<tr><td colspan="2" rowspan="3">$P(B|A) = \dfrac{P(B \cap A)}{P(A)}$</td><td>$P(A \cap B) = P(A) \bullet P(B)$</td></tr>
<tr><td>$P(A \cup B) = P(A) + P(B)$</td></tr>
<tr><td>$P(A \cap B) = P(A) \bullet P(B|A)$</td></tr>
<tr><th colspan="3">SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION</th></tr>
<tr><td colspan="2">Logarithmic
$a = e^{\ln a}$
$a^x = e^{x \ln a}$
$\int a^x\,dx = \dfrac{a^x}{\ln a} + c$</td><td>Homogeneous Equation
$y = vx$ and $\dfrac{dy}{dx} = v + x\dfrac{dv}{dx}$
Linear Factors (Integrating Factors)
$\dfrac{dy}{dx} + Py = Q$
$y \bullet IF = \int Q \bullet IF\,dx$
Where $IF = e^{\int P\,dx}$</td></tr>
<tr><th colspan="3">GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION</th></tr>
<tr><td colspan="2">Equation of the form</td><td>$a\dfrac{d^2y}{dx^2} + b\dfrac{dy}{dx} + cy = 0$</td></tr>
<tr><td colspan="2">Quadratics Formula</td><td>$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$</td></tr>
<tr><td colspan="2">1. Real & different roots</td><td>$y = Ae^{m_1 x} + Be^{m_2 x}$</td></tr>
<tr><td colspan="2">2. Real & equal roots</td><td>$y = e^{mx}(A + Bx)$</td></tr>
<tr><td colspan="2">3. Complex roots</td><td>$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$</td></tr>
</table>

LAPLACE TRANSFORM					
No.	$f(t)$	$F(s)$	No.	$f(t)$	$F(s)$
1.	a	$\frac{a}{s}$	13.	$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
2.	at	$\frac{a}{s^2}$	14.	$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$
3.	t^n	$\frac{n!}{s^{n+1}}$	15.	$\sinh \omega t$	$\frac{\omega}{s^2-\omega^2}$
4.	e^{at}	$\frac{1}{s-a}$	16.	$\cosh \omega t$	$\frac{s}{s^2-\omega^2}$
5.	e^{-at}	$\frac{1}{s+a}$	17.	$e^{at}\sinh \omega t$	$\frac{\omega}{(s-a)^2-\omega^2}$
6.	te^{-at}	$\frac{1}{(s+a)^2}$	18.	$e^{-at}\sinh \omega t$	$\frac{\omega}{(s+a)^2-\omega^2}$
7.	$t^n . e^{at}$, n=1,2,3	$\frac{n!}{(s-a)^{n+1}}$	19.	$e^{-at}\cosh \omega t$	$\frac{s+a}{(s+a)^2-\omega^2}$
8.	$t^n . f(t)$	$(-1)^n \frac{d^n}{ds^n}[F(s)]$	20.	$f_1(t)+f_2(t)$	$F_1(s)+F_2(s)$
9.	$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$	21.	$\int_o^t f(u)du$	$\frac{F(s)}{s}$
10.	$\cos \omega t$	$\frac{s}{s^2+\omega^2}$	22.	$f(t-a)u(t-a)$	$e^{-as}F(s)$
11.	$t\sin \omega t$	$\frac{2\omega s}{(s^2+\omega^2)^2}$	23.	First derivative $\frac{dy}{dt}, y'(t)$	$sY(s)-y(0)$
12.	$t\cos \omega t$	$\frac{s^2-\omega^2}{(s^2+\omega^2)^2}$	24.	Second derivative $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s)-sy(0)-y'(0)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,, \quad k \text{ is constant}$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [Chain Rule]
7.	$\frac{d}{dx}(e^x) = e^x$	8.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
9.	$\frac{d}{dx}(\ln \lvert x\rvert) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln \lvert ax+b\rvert] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
11.	$\frac{d}{dx}(\sin x) = \cos x$	12.	$\frac{d}{dx}(\cos x) = -\sin x$
13.	$\frac{d}{dx}(\tan x) = \sec^2 x$	14.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
15.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$	16.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
17.	$\frac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$	18.	$\frac{d}{dx}[cos^n u] = n\,cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
19.	$\frac{d}{dx}[tan^n u] = n\,tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$		

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \quad ;\{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c \;;\{n \neq -1\}$
3.	$\int k\ dx = kx + c, \quad k \text{ is constant}$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\ dx = \ln\ \lvert x\rvert + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \lvert ax+b\rvert + c$
7.	$\int e^x\ dx = e^x + c$	8.	$\int e^{ax+b}\ dx = \frac{1}{a} \times e^{ax+b} + c$
9.	$\int \sin x\ dx = -\cos x + c$	10.	$\int \cos x\ dx = \sin x + c$
11.	$\int sec^2 x\ dx = \tan x + c$		
12.	$\int \sin(ax+b)\ dx = -\frac{1}{a} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \frac{1}{a} \times sin\,(ax+b) + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		